Campaign
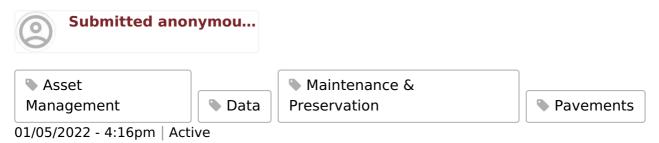
Have a research idea?

Development of a Smartphone-Based Road Performance Data Collection Tool (#3573)

Author:

 Submitted anonymou...

🏷 Asset Management   🏷 Data   🏷 Maintenance & Preservation   🏷 Pavements

01/05/2022 - 4:16pm | Active

Description

The overall ride quality of the pavement is affected by pavement roughness (or smoothness) which also has an influence on fuel consumption and emission levels. Due to the high costs associated with the pavement roughness data collection (characterized through the International Roughness Index [IRI]) on an annual basis, roughness data are collected once few years for secondary (county) roads and not annually collected for large portions of even primary highways. Modern smartphones come with a number of sensors including multi-axis accelerometers, high-resolution digital image sensors, temperature sensors, gyroscopes, light intensity sensors, magnetic field sensors, etc., as well as Global Positioning Systems (GPS). These sensors, especially the 3-axis accelerometers and GPS, offer an efficient and cost-effective means of collecting vehicle vertical acceleration data and estimated pavement roughness leading to significant cost savings for the agencies in terms of road performance data collection. Although a majority of related studies in the recent past have focused on the use of smartphones to detect road anomalies such as bumps, potholes, etc., their application for estimating road roughness condition is relatively new. The first objective of this research would be to develop a smartphone-based (mobile application) pavement roughness measurement system for collecting roughness data from primary highways and secondary (county) roads at an appropriate frequency required for pavement management and maintenance planning. The second objective is an off-shoot of the first and is to identify and evaluate the potential capacities of smartphone-based tool for detecting and measuring other road surface distress types including cracking, rutting, faulting, etc.

A detailed final report will be submitted upon approval of the draft final report by the project Technical Advisory Committee (TAC), comprising Iowa DOT, county, and city engineer representatives. A prototype smartphone-based road performance data collection tool will be provided to TAC for implementation. The recommendations on implementation will be provided in the final report.

Is this related to or a continuation of a previous Iowa DOT research project?

No

Does this idea include matching funds?

No

Anticipated Benefits

The project outcomes are directly implementable. The work would result in a user-friendly and cost-effective smart road performance data collection tool enabling frequent performance data collection and leading to significant reduction in the cost of acquiring pavement performance data and better understanding overall pavement network performance levels.

It would be anticipated that the final tool produced through this research would be made available through the ICEA Service Bureau for distribution to counties, correlation with the IPAT tool, and future updates.

Focus Area

Sustainability / Technology

Project Title

Development of a Smartphone-Based Road Performance Data Collection Tool

Project Number

TR-777

Contracted Agency

Iowa State University

Principal Investigator:

HC **Halil Ceyl...**

SK **Sunghwan K...**

Funding Program

Iowa Highway Research Board

Project Funding

$296,901

Project Start Date

06/01/2019

Current Project End Date

06/30/2023

Partner Agencies

Iowa County Engineers Association Service Bureau

Abstract

The overall ride quality of pavement is affected by pavement roughness (or smoothness) which also has an influence on fuel consumption and emission levels. Due to the high costs associated with pavement roughness data collection (characterized through the International Roughness Index [IRI]) on an annual basis, a low-cost smart phone based nonproprietary collection system is desired by local public agencies (LPAs) to collect their pavement distress data on an annual basis. Also, LPAs have a need to incorporate automatic vehicle location (AVL) technology to better manage their road systems. Modern smartphones come with a number of sensors such as multi-axis accelerometers, high-resolution digital image sensors, temperature sensors, gyroscopes, light intensity sensors, magnetic field sensors, and so on, as well as the Global Positioning Systems (GPS). These sensors, particularly the 3-axis accelerometers and GPS, offer an efficient and cost-effective means of collecting vehicle vertical acceleration data and estimated pavement roughness leading to significant cost savings for the LPAs in terms of road performance data collection. Therefore, a smartphone-based or nonproprietary collection system can be used to accomplish LPA needs of efficient and cost-effective road performance data collection. The data collected can then be transferred (over wireless networks) to and used directly with other pavement and operational management tools already being developed by the Iowa County Engineers Association (ICEA) Service Bureau (e.g., Iowa Pavement Analysis Tool [IPAT], Pavement Structural Analysis Tool [PSAT], and Operations Management System [OMS]).

Project Manager:

Vanessa Goe..

Task Management

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Expert Management

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Comments

No Comments